Hyperkalaemic paralysis due to spironolactone

E. O. Udezue
M.B., D.H.M.S.A.

B. P. Harrold
M.D., F.R.C.P.

Luton and Dunstable Hospital, Luton, Bedfordshire

Summary
A case is reported of an adult who presented with hyperkalaemic muscular paralysis induced by spironolactone.

Introduction

Hypokalaemic muscular weakness is well known (Ward, 1978; Bannister, Ginsbury and Shneerson, 1977) but paralysis due to hyperkalaemia has rarely been described (Hoskins, Vroom and Jarrell, 1975; Van der Meulen, Gilbert and Kane, 1961). The majority of cases are hereditary and episodic (Tyler *et al.*, 1951; Helweg-Larsen, Hauge and Sagild, 1955). A recent case is now reported of iatrogenic hyperkalaemic muscular paralysis.

Case report

A 69-year-old man was admitted with progressive muscular paralysis, starting from the lower and reaching the upper limbs within a period of 5 days. He had had an influenza-like illness, complicated by bronchopneumonia and treated with ampicillin one month previously. There was a history of urinary tract infection some years ago and leg oedema 2 years ago. This oedema had been treated with spironolactone 25 mg 4 times/day without any other diuretic. The oedema cleared and he had remained well on this treatment until the present illness.

At the time of admission to hospital, he was conscious but very weak. He could not move any limbs and could hardly speak or breathe. There was no muscle wasting, but all the limbs were flaccid (power lower limbs MRC grade 0/5, upper limbs MRC grade 1/5). Tendon reflexes were absent, but there was no sensory loss. There was no diplopia and fundoscopy was normal. There were no meningitic signs. Other systems were normal. BP was 150/80 mmHg.

Investigations showed serum potassium, 9·3 mmol/l; sodium, 119 mmol/l; chloride, 90 mmol/l; bicarbonate, 19 mmol/l; calcium, 2·17 mmol/l; phosphate, 1·97 mmol/l; albumin, 44 g/l; serum urea, 31·6 mmol/l. Liver function tests were normal. Hb was 13·4 g/dl; WBC, 18·2 × 10⁹/l with normal differential count; and ESR 63 mm in the first hour (Westergren). ECG (Fig. 1) showed characteristic changes of
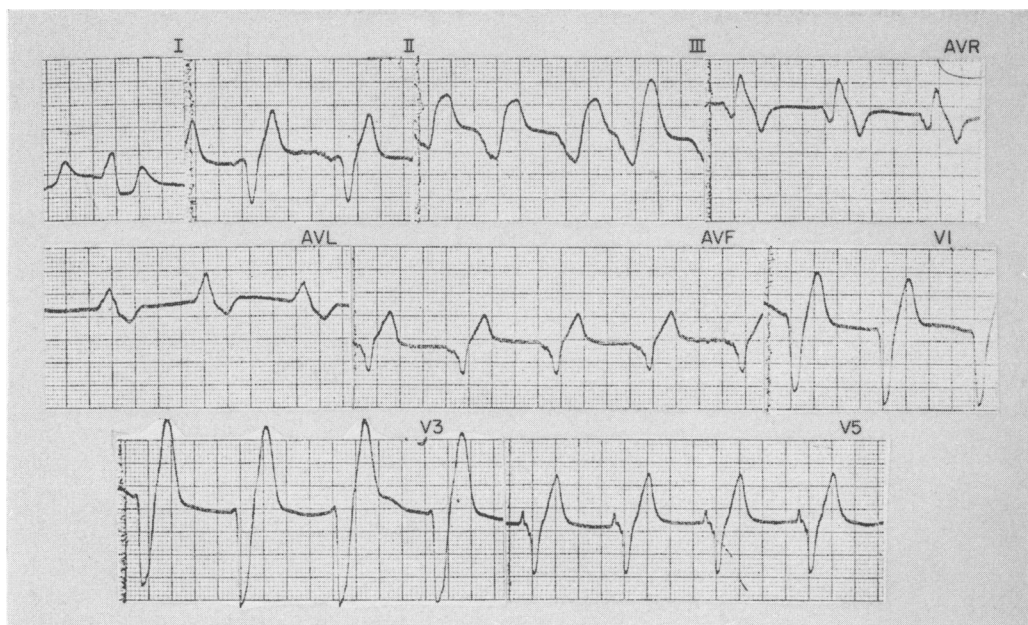

Fig. 1. ECG of the patient on admission with spironolactone-induced hyperkalaemic muscular paralysis.

hyperkalaemia with absent P waves, widened Q-R-S complexes running into tall, peaked T waves. Urine microscopy was normal and culture was sterile.

There was a dramatic response to 20 i.u. of soluble insulin given intravenously with 20 ml 50% glucose; muscle power returning to normal within 5 min. Following 48 hr of peritoneal dialysis and later oral calcium resonium at 15 g 4 times/day for 4 days, serum electrolytes returned to normal. Serum urea was then 7·9 mmol/l. He was ambulant at this stage and felt well. He later developed a deep venous thrombosis of the left calf and died suddenly the same day, after collapsing whilst walking. He presumably had a massive pulmonary embolus. Permission for post-mortem was not given.

Discussion

The clinical features at presentation suggested acute post-infectious polyneuritis (Guillain-Barré syndrome) which was the initial clinical diagnosis, because of the history of recent influenza-like illness. There was, however, no sensory loss or sphincter disturbance.

Spironolactone, an antagonist of aldosterone is a weak diuretic and is usually given with other more potent agents in the treatment of oedema and hypertension. It potentiates their effects and minimizes loss of potassium. It is especially valuable in clinical states associated with high circulating blood levels of aldosterone such as cirrhosis of the liver and primary aldosteronism. It has been suggested for use alone in the treatment of the ascites of liver cirrhosis (Editorial, 1978). Its use as a lone diuretic is not well documented but even as adjunct therapy its use is fraught with danger in poorly selected cases (Greenblatt and Koch-Weser, 1973; Herman and Rado, 1966). Hyperkalaemia is the commonest and most serious side effect, being occasionally associated with sudden death most probably due to arrhythmia (Herman and Rado, 1966). This risk is particularly high in patients with impaired renal function and in those receiving potassium supplements. This should be more so when spironolactone is used alone. Biochemical control is vital in all such cases. Hyponatraemia, dehydration, gastrointestinal, and neurological disturbance including weakness, drowsiness and confusion are other common side effects. Skin rashes and gynaecomastia occur but are not common.

It is interesting that this patient had no cardiac arrhythmia despite a very high level of serum potassium, especially as he also had hyponatraemia which augments hyperkalaemic effects on the muscle membrane (Klein, Egan and Usher, 1960). However, although arrhythmias may be associated with profound and rapid changes in the serum potassium concentration, there is a poor correlation between the serum potassium concentration and the incidence of arrhythmias (Taggart and Slater, 1971). Other factors which affect this include myocardial catecholamine action, temperature, glucose metabolism, variations in the electrophysiological characteristics of different cell types and the potassium gradient across the myocardial cell membrane (Taggart and Slater, 1971). Hyperkalaemia can occur within one week of starting spironolactone (Greenblatt and Koch-Weser, 1973) although the diuretic effect may not become optimal until after about 5 days. It may be that the prolonged period of therapy in this case was associated with increased body potassium as well as hyperkalaemia, thus causing a change in the potassium gradient across the myocardial cell membrane, towards normal. This can only be speculative however as total body potassium was not measured. The high WBC and ESR were probably due to the acute illness; old age was probably also a contributory factor to the high ESR. Uraemia and hyponatraemia are well recognized features of diuretic treatment (Davies and Wilson, 1975). The dramatic response to insulin and glucose, with complete recovery after correction of the hyperkalaemia, ruled out the possibility of the Guillain-Barré syndrome.

Biochemical control is important in diuretic therapy especially, as illustrated in this report, when spironolactone is used.

References

BANNISTER, G., GINSBURG, R. & SHNEERSON, J. (1977) Cardiac arrest due to liquorice-induced hypokalaemia. *British Medical Journal*, **2**, 738.

DAVIES, D.L. & WILSON, G.M. (1975) Diuretics: mechanism of action and clinical application. *Drugs*, **9**, 178.

EDITORIAL (1978) Treatment of hepatic ascites. *British Medical Journal*, **1**, 66.

GREENBLATT, D.J. & KOCH-WESER, J. (1973) Adverse reactions to spironolactone. *Journal of the American Medical Association*, **225**, 2, 40.

HELWEG-LARSEN, H.F., HAUGE, M. & SAGILD, U. (1955) Hereditary transient muscular paralysis in Denmark: genetic aspects of family periodic paralysis and family periodic adynamia. *Acta genetica*. Basle, **5**, 263.

HERMAN, E. & RADO, J. (1966) Fatal hyperkalemic paralysis associated with spironolactone. *Archives of Neurology*. Chicago, **15**, 74.

HOSKINS, B., VROOM, F.Q. & JARRELL, M.A. (1975) Hyperkalemic periodic paralysis. *Archives of Neurology*. Chicago, **33**, 519.

KLEIN, R., EGAN, T. & USHER, P. (1960) Changes in sodium, potassium and water in hyperkalemic periodic paralysis. *Metabolism*, **9**, 1005.

TAGGART, P. & SLATER, J.D.H. (1971) Significance of potassium in genetics of arrhythmias in induced cardiac ischaemia. *British Medical Journal*, **4**, 195.

TYLER, F.H., STEPHENS, F.E., GUNN, F.D. & PERCKOFF, G.T. (1951) Studies in disorders of muscle. VII. Clinical manifestations and inheritance of a type of periodic paralysis without hypopotassemia. *Journal of Clinical Investigation*, **30**, 492.

VAN DER MEULEN, J.P., GILBERT, G.J. & KANE, C.A. (1961) Familial hyperkalemic paralysis with myotinia. *New England Journal of Medicine*, **261**, 1.

WARD, C.D. (1978) Hypokalaemic paralysis. *British Medical Journal*, **2**, 93.